

Formation of Cognitive Competence based on the E-learning System

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This article studies e-learning possibilities and extra teaching skills needed to be developed in the industrial revolution 4.0 since online educational programs are made for easy use. It provides a brief review of ancient learning from the philosophical perspective of some countries. The authors believe that cognitive competence should be developed because the e-learning system is like eye-catching candy and digital era where almost everything is under fingertip in comparison with the past education system where students had to attend lessons. The research question is to test if e-learning environments develop students' cognitive competence. A goal of this study is to identify a method to implement e-learning environments well to develop students' cognitive competence and to achieve learning outcomes of students in higher education. To measure students' cognitive competence, a diagnostic map was used in the experiment conducted at three universities. The result of this study was satisfied to develop students' cognitive competence based on the e-learning system in higher education. Different methods and approaches were used in teaching to achieve the research objectives.

Key words: *Education, e-learning, cognitive competence, students, technology*

Introduction

Learning and teaching are a process where students and teachers take participation simultaneously. This process might continue from traditional formal classroom lessons to a wide range of formal or informal virtual educational platforms where a person may educate himself as a lifelong learner. Nowadays, advanced digital information communication technologies enable human cognitive development in adult education (Kassymova et al., 2019, 2020). It is also to notice that e-learning materials have reduced the teaching hours

because of alternative offline platforms where all the learning materials are in a batch mode without a teacher and students benefit from the convenience which technology provides. For instance, they can learn the desired educational material or repeat the taught material to consolidate what they have studied before or advance their professional knowledge at any time. All students have got the same learning materials available on the web page, and there is an opportunity to acquire knowledge equally regardless of their learning abilities (Mohamed Ismail & Khalib, 2020).

Although the e-learning environments have offered many benefits to society, there have been still many devil's advocates about the implementation of online courses in the academic purpose. For instance, recent research from Newburgh, New York (Leowenberg, 2020) shows that online courses were artificially used for increasing students' performance by changing grades, giving students unlimited opportunities to take an identical exam assignment and even by awarding credits to those students who did not attend class. The flexibility of online courses was exploited by students and teachers. And online course providers may belong to the marketing team or Information Technology specialists are good at their job, and they are able to create online platforms to wow users and to turn the product into eye candy to attract more users. There is a lack of rigorous educational objectives to hit students' learning outcomes (Sujono, 2020). Nowadays, in the digital era, it is essential to train starters, teachers and students who need to know how to use digital technologies.

Quality of education is very important. Law Number 14 in 2005 on Teachers and Lecturers mentions that quality teachers are those who can meet the demands of life changes by making continuous quality improvements in accordance with the development of science and technology (Triyono et al., 2020). The emergence of the Industrial Revolution (IR) 4.0 has sparked the education system worldwide. The impact of IR 4.0 has driven reformation in the structure and management of higher education (Muhsin et al., 2020). Relevant core skills among teachers are essential in the current development of education that necessitates the pedagogical skills and knowledge in the practical strategies (Minghat et al., 2020). Teachers should also be qualified in the digital era; they should possess key core skills such as digital literacy, numeracy, information communication technology (ICT) and cognitive competence how to use them in teaching to support their teaching and professional activities for achieving student's full potential. They should also create a learning environment for students to develop their cognitive skills throughout the educational process; teachers also need to use an appropriate range of teaching tools including e-learning materials, that foster students' cognitive development and promote equality in the educational system. Qualified teachers should have knowledge and understanding of teaching, learning and behaviour management strategies; they should be aware of how to use them in practice, including e-learning materials as well. They should also provide equal opportunities for all their students to achieve their potential (TDA, 2007).

A Brief Historical and Philosophical Review on Learning

Education has been playing a key role in social civilisation since ancient time (Bhaskaran & Portia, 2019). In ancient Indian, education was based on direct interaction between teacher and student. Books were just a part of the system, but education was never considered complete without a teacher. Books were more like a guiding tool, but a teacher presence was essential. Later the students who were successful in their field were known by a teacher whose supervision was provided to a student. In present days, a successful person says that he graduated from a worldwide famous XXX university. Nowadays, due to globalisation and thank the advanced digital technologies, education is getting accessible almost to everyone under one's fingertip.

In comparison with the modern green education system, ancient education was the great value of importance. If we look back through the history of learning, the young generation was taught strictly. It was provided in some places at the remote distance in presence with a teacher whereas education was delivered at home in other places. Learners were paid more attention not only on their intellectual development as well as physical and moral well-being (Thambu, 2017). In this section, the author briefly reviews a history of learning in some leading countries where science and education were believed to be developed and where had been a moral and social civilisation.

The history of learning stems from Ancient Greece. Initial education was involved in teaching rich learners, including only male genders; female learners were mostly taught to singing, dancing, and playing musical instruments. The main goal of education was to prepare the citizens for war. Mostly young learners trained to be physically well. Physical activities included running, jumping, boxing, military training, wrestling, and hunting were in the educational curriculum.

In contrast, cognitive development was given a secondary position which was developed through music, religious ceremonies, and talking to experienced people to improve their debating and conversational capacities (Habib et al., 2015). Nowadays, according to its history, Greece is considered to be a father of science. Although there had been many other philosophers, Socrates, Plato, and Aristotle could become founders of philosophical sciences. In Greece, there were two famous schools in Sparta and Athens which can offer current insights into how education is related to a social and political level. Their education system was based on the cultivation of patriotic spirit, teacher-centred pedagogy, memorisation in a mechanical way; teachers were strict towards their students; physical punishment were extensively used; thus the cane was a symbol of the teacher. Therefore, the production of education was an obedient rather than creative and also unskilled ones. Sparta's education system was based on *creation of brave soldiers, capable to fight and defend one's own*

country; young girls were trained together with boys in the gymnasium. Sparta's education system focused on oral civilisation. In Athens, education was not available to everyone. Slaves, women and poor people were mostly illiterate. Education was provided in the more intellectual form in Athens, and it was not compulsory. Greece put great importance on education in order to sustain and reproduce the political system (Petraki, 2010).

In ancient China, knowledge was delivered orally by elders to their young generation in primitive society until its hieroglyphic writing emerged, approximately 3,000 years ago; professional institutions emerged aiming to teach knowledge; officials acquired knowledge from the Confucian education via government service. Since the First Opium War in 1840, China's education started the modernisation process in the education system; it underwent Japanese and Western imperial powers. China imported its higher education system from the Japanese, Continental European and American models. However, China followed and perpetuated a Confucian epistemological philosophy in higher education, which includes *self-cultivation, family harmony, state-governing and world peace*. In the recent three decades, Chinese contemporary higher education has been experiencing epistemological philosophy and political consideration, such as social development (Wu & Zha, 2018).

The ancient education system of India offered a lot to the present day education system. It is recognised that multilingual and multicultural education has great importance to education. The ancient education system focused on students' holistic development from the perspective of *the inner and outer self*, and its salient feature was to teach students to *a humility, truthfulness, respect for all creations, and self-reliance*. Education was like a donation of the Indian society, and it was free for everyone, including male, female students as well as international students. Teachers played a crucial role in conveying knowledge and decided to conclude a teaching subject when students' acquired knowledge was satisfied. Students lived together with their teachers far from their parents until they achieved their learning outcomes. Education was initially delivered in Temples, and it was based on oral teaching and learning strategies, students remembered what was taught in the class. They focused not only on learning, they also concentrated on physical development; Indian education is considered to be complementary to life because the focus was on a healthy mind and body by meditating in the class (Ancient Education System of India, 2019).

Ancient Egyptians should take rank in intellect among other nations of remote antiquity before Greek and Roman civilisation; they advanced art and sciences; it is *surprising how Egyptians could possess books related to religion, morals, law, rhetoric, geometry, medicine, novels, etc. at a very early date*. Even, Chinese civilisation was art-to-date compared to Egypt. Education was delivered to Egyptians according to their social and political needs from the technical and professional perspective (Laurie, 1893). In Egypt, education was considered to be social. Thus children started to go to school at the age of four or five and

were taught to basic skills such as reading and writing; school subjects included geography, mathematics as well learning a foreign language by doing a lot of spelling and grammar exercises (Lazaridis, 2010).

Research Methodology

The goal of the research methodology of the formation of students' cognitive competence based on the e-learning system is to diagnose the formation of the structural components of cognitive competence (motivational activity, informational activity, reflective activity components), as well as to determine the level of formed indicators of each component. The methodology for the formation of students' cognitive competence is a sequence of the following actions:

- 1) Students' knowledge of the theory of the e-learning system;
- 2) Mastering the methods of applying the e-learning system for mastering future professional activities;
- 3) Mastering the skills of forming cognitive competence based on the e-learning system; Content of academic disciplines selected by students for the implementation of an individual development based on the e-learning system; and,
- 4) The use of digital information and communication technologies for the assimilation of the content of future professional activities.

During the experimental verification of the reliability of the research hypothesis, the following tasks were worked out:

- 1) Determining the significance of the formation of cognitive competence of students to increase the efficiency of the training process for future teachers based on the *e-learning system*.
- 2) Proof of the significance of the proposed model for the formation of cognitive competence of students based on the *e-learning system*.

The tasks were implemented during a search experiment based on interactive seminars by providing blended and problem-based learning styles, and by using e-learning materials including presentations, educational videos, e-mails, Zoom, Skype, WhatsApp, additional educational Internet materials related to the lecture and seminar topics, etc. The experimental groups included 76 students, whereas there were 150 students in the control groups. Experimental and pedagogical work was carried out with students of Abai Kazakh National Pedagogical University (20 students of the speciality "Pedagogy and Psychology" in the 1st group), with students of Yogyakarta State University (20 students of the speciality teacher of mathematics in the 2nd group), as well as with students studying in the speciality "Social

pedagogy and self-knowledge", the 3rd group (36 students). There are 150 students of Al-Farabi Kazakh National University were included in the control group. A set of methods was used to have an idea of the qualitative characteristics of cognitive competence according to the criterion "formation of positive motivation for the e-learning system for preparation for future professional activity" among students in control and experimental groups. The author conducted a survey that was developed. So, according to the results of the survey, the following quality characteristics were obtained for the following indicators:

- 1) There is no self-discipline in the e-learning system because students do not have a face-to-face interaction; additionally, e-learning materials might be postponed to a later time because of its online access.
- 2) Traditional teaching is better for cognitive development. As it allows the participants to ask questions and other members to join the discussion. E-training is good for a refresher course where students have already completed their education but just want to brush up their knowledge.
- 3) There is still a lack of flexibility in the e-learning system. For instance, there is no chance to ask a question; the best learning happens when students discover the solutions on their own – by asking questions and obtaining clarification on their unclear questions; this process is difficult with e-learning, even it is impossible, to do.
- 4) We face a lack of input from trainers; e-learning is structured by a course developer without students' opinion about what they want to learn. In traditional lessons, teachers are in the classroom and discuss what their students want to study and what they expect from a module as learning outcomes.
- 5) E-learning materials should contain some learning strategies that can stimulate students' cognitive development, for example, case study, student-centred learning, discussion, etc. instead of putting all materials online and let the students learn all of them. They need to widen their knowledge from a variety of media and learning instruction so their critical thinking, creativity, teamwork, and problem-solving skills can be improved.
- 6) It depends on many factors. It is not easy to create a good e-learning platform. Developing an effective e-learning course takes time, costs much money, and a great amount of expertise. A good e-learning course involves multimedia, target audience, constant technical support. It is easier to attend traditional classes where students can interact with each other.
- 7) It might depend on instructor's way of using this program. By using e-learning, students might save time and money. They can join the class from anywhere and will have plenty of time to do the assignments. Individual assignments are more effective while doing e-learning. Some campus-based universities, where students are doing their postgraduate program, almost never provide e-learning materials. However, some students used to join online lessons many times while they were studying their bachelor programs. Some lecturers usually are busy, and mostly use that program. It is believed that any assignment

that makes the students dig the information/knowledge from different sources might have a great impact on students' cognitive skills.

- 8) E-learning has a lack of transformational power. It is considered that e-learning is effective for improving language proficiency, especially when a learner completes one level and moves to another one. E-learning helps learners and teachers as well in enhancing the learning and teaching process.
- 9) E-learning does not provide teamwork that can produce learning outcomes to core learning problems; similarly, live training can foster team-building and create a learning environment where students can deepen their relationships, get to know each other better in life and learn in a unique environment where they all have the same goal to achieve in the educational process.

In both groups, the formation of positive motivation for the e-learning system for preparing for future professional activities is less clearly presented. Students are not sufficiently formed and developed the motivational activity component of cognitive competence necessary for mastering future professional activities based on the e-learning system. There is a low motivation to organise one's activities aimed at mastering the content of academic disciplines based on the e-learning system. In addition to students, teachers took part in the ascertaining experiment. An analysis of the teachers' answers to the questionnaire showed that they are aware of the importance of forming cognitive competence of students based on the e-learning system:

- Online classroom encourages cooperation among students; they learn from each other to respect each other's thoughts and learn to listen to others.
- E-learning materials are beneficial when students work on PBL activities; students are compelled to think about, organise, and use online information in ways that encourage active construction of meaning and solve the tasks.
- Good e-learning practice encourages active learning; group work and other activities that foster peer learning are encouraged to develop cognitive and social skills of students.
- Good online practice gives prompt feedback about students' e-learning outcomes; students will have access to their grades and feedback at any time so that they can track their learning progress.
- Presentations are used to deliver content via electronic media so that students can study anytime and anywhere via any online devices; lecturers can upload their lectures or syllabus to the system for students to review for self-study.
- E-learning encourages associative and organisational processes which play an important role in learning and memory.
- Computer technology enables to create e-books that are in electronic format; they are readable by electronic devices, such as notebook computers, tablets, and mobile phones; flexibility and accessibility of computer technologies motivate students' internal and

external needs.

- Good e-learning materials are based on time and control its proper utilisation.
- E-learning materials provide ubiquitous access to learning and teaching materials and as well as learning outcomes. Students can analyse their learning outcomes at a remote place and consider to fulfil the educational gaps where they need to; this process evokes the cognitive development of students.
- E-learning supports students to achieve their maximum potential by authentication at different levels (device, software, virtual learning environment, specific course, blended learning and PBL, etc.).
- Good online learning materials respect diverse talents and ways of learning styles of students; it means that students learn on their pace.
- E-learning encourages technical competence and digital literacy of students without advanced ICT skills; they will be made aware of the technical instructions needed to reach the learning outcomes successfully.
- Students might individually advance their prior knowledge by e-learning when they have spare time.
- E-learning encourages an administrative review; the administration can control all the educational process by accessing online teaching and learning materials.

At the Stage of the Ascertaining Experiment, the distribution of the students of the experimental and control groups by the levels of cognitive competence was revealed in Table 1.

Table 1: The number of students by the level of cognitive competence at the beginning of the experimental work

Level of cognitive competence	Amount of students (%)	
	Experimental group	Control group (150)
High level	12 students (16 %)	9 students (12%)
Average level	43 students (56%)	85 students (53%)
Low level	21 students (28 %)	56 students (35 %)
	Total: 76 students	Total: 150 students

For this purpose, the author used a diagnostic map for studying the cognitive competence of students. So, applying the results of the questionnaire, the author filled out the diagnostic map of all the students participating in the experiment. In contrast, for quantitative processing of the results (qualitative characteristics) were translated into scores/points (from 0 to 4). A generalisation of the results of the ascertaining experiment showed the predominance in the studied (experimental and control) groups of students with low and medium levels of cognitive competence formation, as shown in Table 2, which indicates the severity of the

problem and suggests huge reserves for the formation of motivational activity, informational activity and reflective activity components.

Table 2: Diagnostic results of the formation of students' cognitive competence in experimental and control groups at the beginning of the experiment.

Components	The number of students by levels of cognitive competence formation and general indicators of the formation of cognitive competence by its structural components							
	Experimental groups				Control groups			
	High (H)	Average (A)	Low (L)	General indicator	High (H)	Average (A)	Low (L)	General indicator
<i>Motivational activity</i>	4	2,8	1,8	2,1	3	1,5	2,7	1,4
<i>Informational activity</i>	1,1	2,7	1,9	1,7	1,0	2,3	2,0	1,3
<i>Reflective activity</i>	4	2,6	2,0	1,7	1,3	1,9	2,2	1,3
Average value	Formation Rate			1,8	Formation Rate			1,3

The result of the stating section at the beginning of the experimental work was the confirmation that there is a need for more intensive inclusion of students in various types of educational activities of the holistic pedagogical process of the university. There was a need to search and **verify adequate pedagogical conditions** that contribute to the implementation of the tasks of forming cognitive competence of students based on the e-learning system. Thus, the initial analysis of the formation of students' cognitive competence led to the conclusion about the need for focused pedagogical work to accompany the formation of students' cognitive competence based on the e-learning system.

The formation of students' cognitive competence is considered by the author as part of the holistic pedagogical process of the university, implemented through educational activities for the formation of cognitive competence of students, taking into account the **pedagogical conditions** considered by the author:

- 1) formation of positive motivation for students to learn on the basis of the e-learning system;

- 2) organisation of the learning process, taking into account competence, student-oriented, subject-activity and systematic approaches to learning;
- 3) selection of content, methods and forms of training that ensure the formation of cognitive competence.

When selecting information material during the educational process of the university, the author was guided by the position of didactics - on the nature of education and upbringing. So, taking into account the psychological and age characteristics of students, the content of information material should not only be accessible but also based on their life experience, taking into account their interests and needs. It should be noted that the purpose of the experiment was to create pedagogical conditions for the formation of students' cognitive competence by introducing a manual and training program into the educational process that has functional significance and practical orientation.

- 1) Training course "Pedagogical measurement", aimed at shaping the development of the methodological foundations of pedagogical measurements, improving measurement accuracy, creating methods for interpreting measurement results, improving scaling methods for data and as well as at creating conditions for the formation and development of students' cognitive competence based on the e-learning system. The goal falls into a number of fundamental tasks:

- formation of the ability to apply theoretical knowledge;
- formation of the ability to highlight key concepts in a real situation;
- formation of the ability to interpret a key real-life situation regarding their professional life;
- formation of the ability to critically evaluate and analyse a situation;
- formation of a productive reading skill;
- formation of the ability to collect information and solve the learning problem tasks;
- formation of the ability to use digital technologies for learning and teaching materials;
- creation of interactive space for the development of the personality students.

- 2) Training program on the formation of students' cognitive competence based on the e-learning system is relevant in the search for methods of developing cognitive competence of an individual outside the framework of academic education (Ramalingam et al., 2019). In the framework of this research work, cognitive competence is considered as a component of professional training for the effectiveness of an individual's vital activity, its ability to constructively overcome difficult professional life situations, constructively build interpersonal relationships and focus on subjective social functioning. The development of cognitive competence is impossible without knowledge. Cognitive competence requires constant cognitive activities (information retrieval, analysis, interpretation, problem-

solving and decision-making skills, etc.). Cognitive training is a special method of teaching and learning, involving the active intellectual and mental activity of students, which transforms the quality of their social functioning.

Cognitive activity is one of the foundations for the success of this training. Stimulation of cognitive activity in the process of work is achieved by analysing problem-based learning tasks for future teachers from students' professional life. Students work on several stages:

- Stage 1: Remembering and comprehension of a situation. Students will write down any situation that was undergone in their professional life, or that might be faced during their future teaching career.
- Stage 2: Analysis and evaluation of a situation by implementing their theoretical knowledge. Students will analyse any professional problem and highlight the key issues of the situation.
- Stage 3: Interpretation. Students will select basic concepts in theory and identify the fundamental ideas of the characters in the situation; then they will make their own arguments;
- Stage 4: Criticism and decision. Students will detect the problems and criticise them; then they will recommend some possible ideas to solve professional problems.

Social cognitive activity is carried out through a discussion of the material written in the classroom and verbalisation of their ideas and thoughts. It is worth noting that just working in a group allows students to make the process of analysing a situation more effective, since the students are faced with the task of formulating their ideas about what they have experienced, and this also requires active thinking skills.

Research Experiment and Results

After the formative stage of the experimental work, the **control stage of this experiment** was carried out to analyse the results of the experimental work on the formation of cognitive competence of students based on the e-learning system, to verify the effectiveness of solving research problems and the hypothesis put forward. Summarising the results of the formative stage of the experiment, it should be noted that qualitative and quantitative changes affected the students' personality, which occurred in the areas of the educational activity of students. Thus, the author obtained results showing quantitative changes in the dynamics of the formation of criteria for the formation of students' cognitive competence, as shown in Tables 3, 4, 5, 6, 7, and 8.

Table 3: Level of formation of the motivational-value component of the cognitive competence of students in the experimental groups at the beginning and end of the experiment

The generalised result of the formation of the motivational-value component of the cognitive competence of students in experimental classes				
Classes	At the beginning of the experiment		At the end of the experiment	
	Total		Total	
1-st group	2		3,5	
2-nd group	1,2		3,7	
3-rd group	2,5		2,6	
Level of formation of the criterion of "positive motivation for learning based on the e-learning system"	1,9		Level of formation of the criterion of "positive motivation for learning based on the e-learning system"	3,3

Table 4: Level of formation of the informational activity component of the cognitive competence of students in the experimental classes at the beginning and end of the experiment

The generalised result of the formation of the informational activity component of the cognitive competence of students in experimental classes				
Classes	At the beginning of the experiment		At the end of the experiment	
	Total		Total	
1-st group	2,1		3,5	
2-nd group	1,7		3,7	
3-rd group	2		2,6	
Level of formation of the criterion "understanding the importance of the e-learning system for preparing for future professional activities"	1,9		Level of formation of the criterion "understanding the importance of the e-learning system for preparing for future professional activities"	3,3

Table 5: Level of formation of the reflective activity component of the cognitive competence of students in the experimental groups at the beginning and end of the experiment

The generalised result of the formation of the reflective activity component of the cognitive competence of students in experimental groups				
Classes	At the beginning of the experiment		At the end of the experiment	
	Total		Total	
1-st group	2,1		3,1	
2-nd group	1,8		4	
3-rd group	2		3,5	
Level of formation of the criterion "reflection of activity based on the e-learning system"		2	Level of formation of the criterion "reflection of activity based on the e-learning system"	3,5

Table 6: Level of formation of the motivational activity component of cognitive competence in control groups at the beginning and end of the experiment

The generalised result of the formation of the motivational activity component of the cognitive competence of students in control groups				
Classes	At the beginning of the experiment		At the end of the experiment	
	Total		Total	
1-st group	1,4		1,5	
2-nd group	1,3		1,5	
3-rd group	1,3		2,4	
Level of formation of the criterion of "positive motivation for learning based on the e-learning system"		1,2	Level of formation of the criterion of "positive motivation for learning based on the e-learning system"	1,8

Table 7: Level of formation of the informational activity component of the cognitive competence of students in control groups at the beginning and end of the experiment

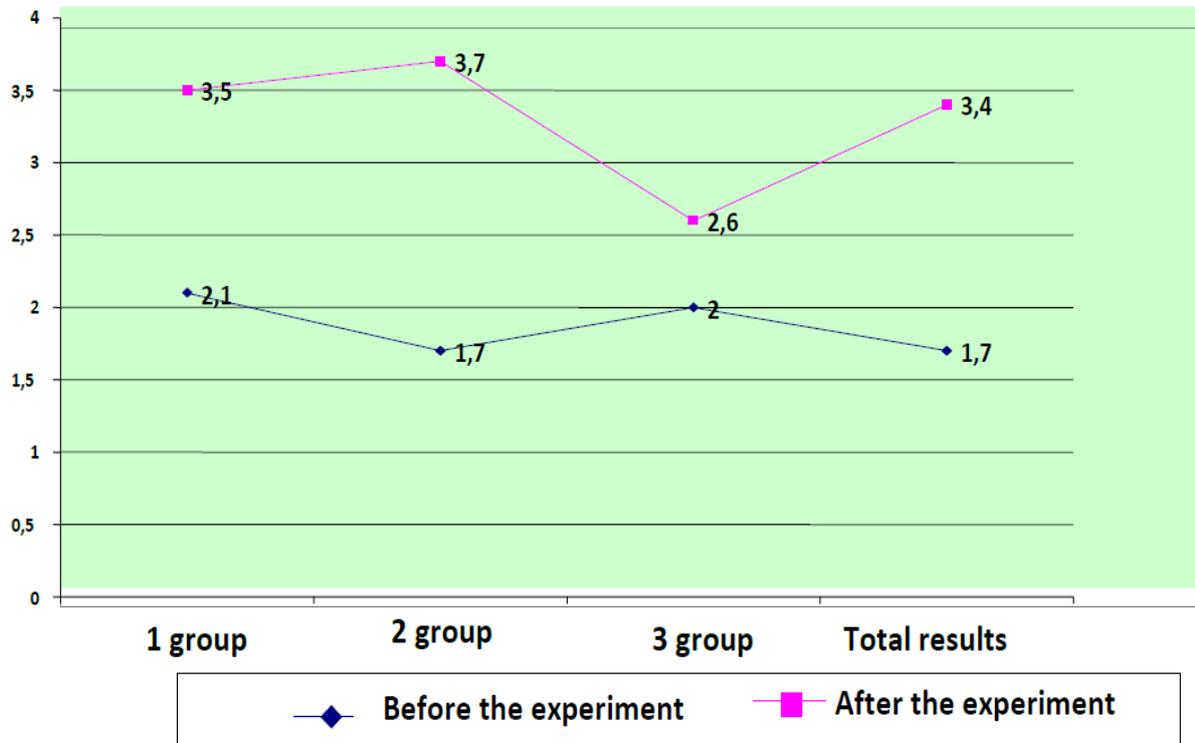
The generalised result of the formation of the informational activity component of cognitive competence in control classes				
Classes	At the beginning of the experiment		At the end of the experiment	
	Total		Total	
1-st group	1,4		2,2	
2-nd group	1,5		2,4	
3-rd group	1,4		2,4	
Level of formation of the criterion "understanding the importance of the e-learning system for preparing for future professional activities"	1,3		Level of formation of the criterion "understanding the importance of the e-learning system for preparing for future professional activities"	2,4

Table 8: Level of formation of the reflective activity component of cognitive competence in control groups at the beginning and end of the experiment

The generalised result of the formation of the reflective-activity component of the cognitive competence of students in control groups				
Classes	At the beginning of the experiment		At the end of the experiment	
	Total		Total	
1-st group	1,3		2,3	
2-nd group	1,3		2,8	
3-rd group	1,2		2,4	
Level of formation of the criterion "reflection of activity based on the e-learning system"	1,3		Level of formation of the criterion "reflection of activity based on the e-learning system"	2,6

The diagram shows the dynamics of growth in the level of cognitive competence of students before and after the formative experiment for all groups (see Figure 1).

Figure 1. The level of cognitive competence of students before and after the formative experiment



The author obtained comparative data on the level of formation of cognitive competence of students in control and experimental groups at the beginning and completion of experimental work (see Table 9).

Table 9: Generalised diagnostic results of the formation of students' cognitive competence of experimental and control groups at the beginning and end of the experiment

The general rate of formation	Generalised results in the experimental and control classes at the beginning and end of the experiment			
	Start of the experiment (experimental groups)	End of experiment (experimental groups)	Start of the experiment (control groups)	End of experiment (control groups)
	1.8 - low score	3.5 - high score	1,3 - low score	2.3 - average score

The control experiment revealed that the level of formation of cognitive competence of students of experimental groups has significantly increased. As a result of the work, students of the experimental group began to show interest in the learning process based on the e-

learning system. This was reflected in the students' interesting response to the teacher's tasks, providing for independent search activity, requiring the ability to select the necessary material for the academic discipline based on the e-learning system, and independently transfer the available knowledge to new problem situations. Students began to be active in mastering professional knowledge and skills. Thus, the effectiveness of the process of forming the cognitive competence of students based on the e-learning system can be assessed by changes in the levels of formation of structural components of the cognitive competence of students. The control examination was carried out similarly to a stating study by the same methods. Thus, in terms of the level of formation of cognitive competence of students, the quantitative composition of groups of students has undergone changes (see Figure 1 and Table 9). The analysis of the table data allows us to state that in the control group, there were no significant changes in the levels of students' cognitive competence. In the experimental group, where the pedagogical conditions considered by us were taken into account in the educational process, the level of students' cognitive competence is higher than in the control group.

Conclusions

To sum up, current education switched from the teacher-centred to the student-centred approaches. Digital technologies could offer many possibilities to provide lessons from campus-based education via blended learning including problem-based learning style, to online education by providing an individual teaching approach where knowledge can be delivered to each student individually for instance by Skype or in a fixed amount of students in the virtual environments. The analysis of the results revealed by comparing the control and experimental groups showed that the number of students who had positive changes due to the active inclusion in various types of educational activities increased, which was author's assumption at the beginning of the experimental work. The assessment of the results of the experimental work was based on criteria and indicators characterising the cognitive competence of students based on the e-learning system. In the course of the study, a methodology for the formation of students' cognitive competence based on the e-learning system and a comprehensive methodology for studying the cognitive competence of students were developed. Testing of the diagnostic map of the level of cognitive competence has proved the appropriateness of its use. Additionally, further recommendations for e-learning environments are to come up with innovative teaching methods for diverse multinational students in order to hit the learning outcomes of individuals and to avoid abuse about cheating the exam assignment tasks answer from the Internet.



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